The Overlooked Power of Music

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Imagine a time where you were deeply upset about something and had multiple people trying to talk you through it. However, none of their words seemed to resonate. But then, you hear a song and the waves of sadness seem to disappear. The reason for this is that music can reach parts of the brain that words cannot.

Music has been around for ages, but some beneficial effects of it are just now being brought to light. Music is more than just an art form, as it can affect neurological, psychological and physical functioning. Music can increase one's ability to learn, process new information, remember different material, and even help express different emotions. Different genres of music can have varying effects as well. The pace of the beat, or sound of the melody can cause different neurons to fire which in turn can cause different hormones to be released and different memories or feelings to pop up.

The purpose of this research is to understand why music can reach parts of the brain that words cannot, and to determine how different types of music can affect a person’s mind. When we hear upbeat and exciting music, our brain secretes different hormones in comparison to when we hear sad or calming music. These hormones have different effects on our body that directly contribute to our mood and other cognitive abilities. But not only does music impact day-to-day inconveniences, it can also help people recover from serious brain damage such as Alzheimer's disease and dementia because the way people process music can subconsciously help with their physical movement and memory.

I've experienced the effects music can have on a person. While it has triggered feelings of sadness and grief in my own life, it has also improved my mood and stimulated motivation. It’s possible that music can work wonders on others too.

Not only is music an effective mechanism in shifting our behavior, it also has powerful implications on the mind as well. Music affects our neurological, psychological and physical functioning, and is therefore a valuable tool to be used by all people in their daily lives, including patients recovering from serious brain damage.

Why I Decided to Research Music

I've learned through my own experiences that music has powerful implications on the mind. Through trial and error, I have figured out which types of music play the most influential role in controlling and shifting my behavior. Sometimes it can be a struggle to shift your mood on your own, however music can be a great tool to do so in a short period of time.

These past two years, my anxiety has reached a new high. I would wake up anxious, go to bed anxious, all of it. I couldn't escape it. Every aspect of my life would be tainted by it; school, softball, social life, family life, everything. Anxiety is different in everyone, but for me it consumed me. It came in the form of overthinking, hyper-fixation and overwhelming panic. Minor inconveniences would replay over in my head, and little things would affect my entire day. I'd constantly be shaky, and anything could set me off. I can't even explain it but put simply I have no idea what it's like to have silence in my head. I am constantly stressing about the past, present and future simultaneously, and it's exhausting. All I wanted was to find a way to turn that anxiety off, or at least escape it for a bit. I really struggled with finding ways to calm myself down and believe me I've tried almost everything. The things that many people find to be "de-stressing" wouldn't work for me. I've tried exercising, but I would get hyper fixated on my appearance and physical health. I've tried yoga, but my mind would not allow me let go of the thoughts circulating in my head. I've tried controlled breathing, but then I would become too focused and think too much on my breath that the exercise became useless.

In the past, when I would get consumed with anxiety like this, I would try to just take a 30 minute break and fall asleep. However, it got to a point where I couldn't even sleep anymore. I was at a loss, and I didn't know what to do. And I'll be honest, I've tried listening to music to calm me down before, but that didn't even work; at least at first.

When I first decided to try listening to music to relieve my anxiety, I would pick some of my favorite songs and listen to them hoping it would shift my focus. I'd pick upbeat happy songs that I know have been effective in previously changing my mood and making me smile. However, when I was in an anxious state, listening to these songs would further frustrate me because I couldn't enjoy it. I would start the song and turn it off after about 10 seconds because the fast-paced song would make me shake even more. Therefore, I stopped trying to listen to music to calm my angst because if my favorite song couldn't help, I assumed no other songs would. But that's where I was wrong. At the time, I didn't understand or think about the reasons why music could shift my mood, I just assumed that I should listen to things that made me happy and everything would be fixed. But anxiety is a different emotion than sadness, and the music that helped me when I was sad isn't the same music that would help me when I was anxious.

After examination, I've learned that classical music, specifically piano music helps ease my mind when I'm having an anxiety attack. I'd put on my air pods and quietly listen to the piano for a bit. I would then try to carry on with my day while keeping the music playing in the background and eventually my breathing would slow, my heart rate would decrease, and my shakiness would steady. This didn't cure my anxiety, but for the time being it definitely helped lesson it. All of this led to the question; how could music connect the mind and the body?

Often, people mistake the mind and body to be two separate entities. However, that is not the case as both systems are connected through the mind-body connection. When you are feeling

a certain way, whether that be happy, sad, anxious, ect, your body responds to these thoughts and emotions. Smiling after a happy thought, crying after a feeling of grief, increased heart and breathing rates after signs of stress, are all examples of this mind-body connection. Music has been proven to be a bridge that can connect the mind and the body because even a single song has the capability to affect our neurological, psychological, and physical functioning.

The Brain

The brain is a very complex organ that controls every process that regulates our body. The thoughts and memories we have, the skills we possess, the emotions we feel, our basic functioning such as breathing, movement and more, are all mediated by our brain.

The human brain is split up into three main sections; the forebrain, the midbrain and the hindbrain. The forebrain is responsible for thinking, perceiving, responding to, and processing sensory information of the world around you. Essentially, the major parts of the forebrain are the cerebrum, thalamus, hypothalamus, and the limbic system, all of which are crucially important in the modulation of emotion, motivation, and rewards. The limbic system is referred to as the "emotional brain" because it is responsible for the majority of emotional processing. It contains the important structures of the amygdala, hippocampus, thalamus and the hypothalamus, and when any of these structures are stimulated, such as through music, the body's emotional response is activated.

The Neurologic Effects of Music on the Brain

The neurological effects music has on the brain deals with how music influences the nervous system. This includes anything that involves the brain, spinal cord or nerves.

According to neuroscience studies performed by Stefan Koelsch "Music is capable of evoking exceptionally strong emotions and of reliably affecting the mood of individuals" and can

evoke activity changes in the amygdala, limbic system and some other structures of the brain (Koelsch S). As music stimulates sections of the brain, neurotransmitters are released in response. These neurotransmitters act as messengers and carry chemical signals from one neuron to the next until the appropriate response is reached. These chemicals flood our brain creating an emotional effect that causes us to respond emotionally to what we hear. The reaction we experience can range anywhere from happiness and excitement to sadness or nostalgia.

The positive emotional response felt by an individual upon hearing certain music is controlled by the neurotransmitter dopamine. Dopamine is the “feel good” hormone that causes an individual to feel pleasure, satisfaction and motivation upon accomplishing something. It’s a major contributor in how happy we feel. When an individual listens to a song that gives them “chills”, which can be described as an intense feeling of emotion, the brain releases dopamine. Therefore, the same surge of happiness you get when you physically achieve something can also be felt by listening to a certain song. Listening to the music you love will make your brain release more dopamine, which plays a vital role in improving one’s mood by directly impacting the reward experience a person feels (Ferreri L et al. 2019).

There are three parts of the brain that respond the most to the emotional aspects of music; the nucleus accumbens, the amygdala, and the cerebellum.

The nucleus accumbens is a key structure involved in “mediating motivational processes” and said to be “the functional interface between limbic and motor systems” (Salgado and Kaplitt 2015). Through increased (or decreased) firings of specific neurons, the NAc acts in a way that affects a person's natural rewards system. The body's reward system depends on the communication of neurotransmitter dopamine to create a feeling of pleasure, pride or satisfaction. Dopamine reacts with neurons in the nucleus accumbens to motivate the body to

obtain these rewards revealing how the NAc plays an essential role in a positive emotional pathway.

Music has also proved to have a strong effect on the neural system of the amygdala in the limbic system. It was found that “the amygdala is probably the structure most implicated in emotional processing.” “It has been recognized that the amygdala is a key element of the neural basis of emotion” (Cardinal et al. 2002).

The amygdala has different layers of neurons that can receive signals from music and therefore elicit an emotional response. It’s “been implicated in the initiation, generation, detection, maintenance and termination of emotions” in response to different stimuli. When music is played, the sounds and vibrations stimulate sections of the brain to release neurotransmitters. Activity changes in the amygdala were observed in response to both positive and negative stimuli from music. When a positive stimulus is felt from an upbeat, high, rhythmic song, a positive emotion will result. When a negative stimulus from a slower and softer song is heard, the amygdala will elicit a different and more unpleasant response (Koelsch S).

The amygdala has dopamine receptors, and the neurotransmitter dopamine plays an important role in a person’s cognitive, emotional, and behavioral functioning because it is crucial for the reward experience induced by music (Ferreri L et al. 2019). Ultimately, when exciting songs are heard, it triggers the body to release dopamine which boosts an individual's happiness. In the same way that an achievement can induce a sense of pride and joy, music can do the same thing. The same neurotransmitters are sent and received throughout the body to produce the same positive emotions.

However, the amygdala is not only in charge of producing positive emotions like happiness. The amygdala also can mediate a calming or more negative emotional response such as anger, grief, fear, or anxiety.

Upon hearing sad music, the brain is tricked into producing a hormone called prolactin. When the brain hears sad music, it brings up the same feelings as an actual painful experience would. By resembling the same neurological processing as a physical traumatic event, the brain in turn releases the same compensatory hormone. Prolactin has a consoling effect on the body and produces feelings of calmness that counteract the mental pain. (Ladinig et al. 2021)

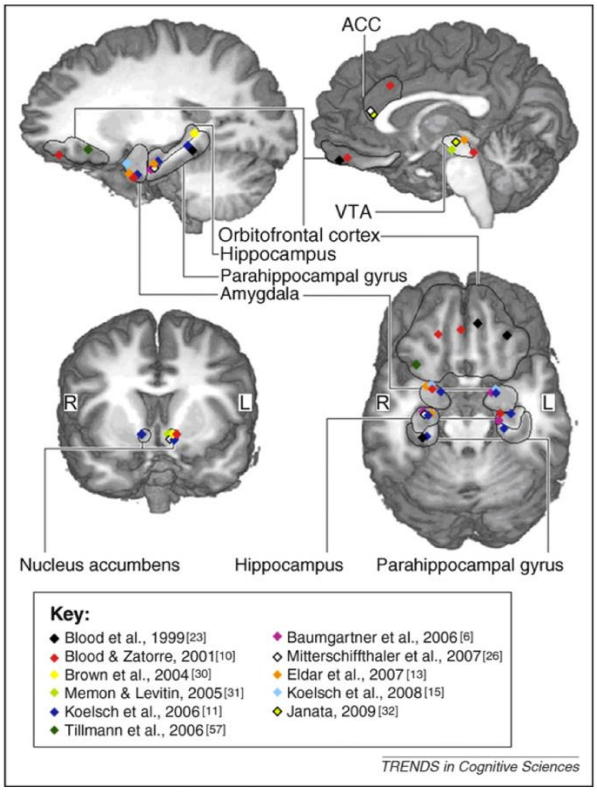

Figure 1. Illustration of some structures belonging to the limbic/paralimbic system. The diamonds represent music-evoked activity changes in these structures (see figure legend for references). Note the repeatedly reported activations of amygdala, nucleus accumbens and hippocampus, reflecting that music is capable of modulating activity in core structures of emotion. Top left: view of the right hemisphere; top right: medial view; bottom left: anterior view; bottom right: bottom view.

The figure above shows the effects music can have on structures in the limbic/paralimbic system. It illustrates the music-evoked activity changes in different structures of the brain such as the amygdala and nucleus accumbens. The repeated activation in the amygdala indicates that music is capable of modulating activity in core structures of emotion (Koelsch S).

However, not only does music affect us neurologically, but also psychologically.

Psychological Effects of Music

Whereas the neurotransmitters and surge of dopamine deals with the neurological aspect music has on the brain, how this hormone actually makes a person feel is the psychological aspect. So, the actual feelings of pleasure, satisfaction and motivation that you get resembles the psychological response. Music plays a significant role in your thoughts, feelings, and behaviors. It can create excitement, energize the body, relax the mind, stimulate concentration and even help people better manage pain and grief. For example, when a person listens to upbeat songs with a faster tempo, it can elicit excitement and motivation in the individual listening. Or, when a person listens to songs that remind them of their childhood, it can induce feelings of nostalgia.

After acknowledging the role that music plays in connecting the mind and the body, I started listening to different songs depending on what mood I was in. From doing so, I've learned that there are a few songs that have been incredibly helpful in transforming my disposition.

When I am lacking incentive and need to be energized and motivated for something, I've learned to turn to upbeat, fast, more aggressive but also inspirational songs. Songs that have shown to give me a surge of energy so I can regain focus and be enthusiastic for the task at hand. If I'm not mentally prepared for a softball game and need a way to pump myself up, I turn to music. The song "Miss Independent" has been my go-to song for getting my head in the right

mindset to play a game. The stronger and more aggressive beats in the song gives me a sense of adrenaline and makes me eager and excited to play in my game. I feel re-energized and am more amped to play.

However, I don't only listen to music in order to motivate myself. Sometimes I look for ways to feel comforted and therefore choose songs that provide me with a sense of support and reassurance. There have been times where I've felt unsettled and upset and talking about the issue did not help. Nothing was being processed and no words spoken resonated with me. The normal conversation didn't help improve my mood because the consoling words were not being processed. However, moments later, if I listened to a song with the same melancholy feeling as I felt, I would almost immediately feel comforted.

This revealed to me that when experiencing some type of grief, music can be an outlet for comfort that normal words cannot reach. Rather than trying to understand your grief or explain your emotions, you can choose to listen to a related song instead. Choose a song that makes you feel like you're not alone and that helps you to comprehend that other people have experienced this issue too. Having that feeling of comfort that there are people out there who know how you feel and who express that in a beautiful, but sad way can reach a part of your brain that normal conversations cannot. So, rather than trying to explain over and over again how you're feeling, pick a song and listen to it to decompress.

A final example of how I use music to cope with events in my own life is how I've learned to turn to classical music for my anxiety. When I was first experimenting with music, I expected that listening to my favorite song would be the best option to lessen my anxiety attack. However, listening to this upbeat, fast-paced song made me feel more shaken up than I was before. I then tried to listen to slower, sadder, hoping it would alleviate my anxiety and provide

me with reassurance to calm me down, but that didn't help either. It turned out that the only type of music that relieved my anxiety was classical music: songs with no words, no loud aggressive beats, just soft, steady, gentle tunes. Therefore, instead of listening to upbeat, fast-tempo music that can re-stimulate and trigger feelings of angst, non-lyrical music with a slower tempo can serve as a distractor from patients suffering with anxiety and should be used instead.

According to Devrim Erginsoy Osmanoglu and Hüseyin Yilmaz "There are two types of anxiety; trait anxiety and state anxiety. State anxiety is a state of unease and unhappiness that arises as a result of a temporary situation experienced by the individual but disappears as soon as the threat disappears. The state of which the individual is afraid is evident." "This situation is not considered a problem and is necessary for survival in threat situations." However, "trait anxiety on the other hand refers to the individual's disposition to experience anxiety. The individual perceives the situations in which he/she is as stressful and tends to interpret events negatively. Individuals with high levels of trait anxiety can generally feel uneasiness and unhappiness" (Erginsoy Osmanoglu and Yilmaz 2019). In a person with trait anxiety, they carry this anxiety across all different situations. Even when there is no apparent threat, or the threat disappears, the fear and overwhelming worry felt remains. In my life, I've been experiencing trait anxiety because these negative emotions linked to anxiety are felt daily for all different scenarios, sometimes for even no reason at all. Osmanoglu and Yilmaz declare that if no effective coping mechanism is found and the "negative emotions such as anxiety are severe or prolonged, the psychological well-being interferes negatively with an individual's ability to maintain daily life with positive emotions" (Osmanoglu and Yilmaz 2019). For this reason, I've been needing a method to help ease my mind and control the constant worries and fears that come alongside the

anxious feelings. Luckily, classical music has been proven to be an effective method for easing people's minds who struggle with anxiety.

Classical music is one of the most beneficial tools to reduce anxiety from the slow tempo and constant rhythm of it. A study was performed by Devrim Osmanoglu and Hüseyin Yilmaz to test how different types of music affects individuals living with both types of anxiety. They determined that "there is a significant difference between the pre-test and post-test scores taken from the Trait Anxiety Scale ($p = .004 < 0.01$) which is indicative of music reducing the level of trait anxiety." (Erginsoy Osmanoglu and Yilmaz 2019). This proves that the right kind of music can have a calming effect on an individual struggling with anxiety. Furthermore, when analyzing the specific aspect of music that helps ease an individual with anxiety, "it appears that the tempo of the music is the most important factor, with slow and flowing music with 60 to 80 beats per minute having positive outcomes on relaxation and pain relief." (Nilsson U 2008). Therefore, therapeutic music should be "non-lyrical, consist predominantly of low tones, comprise mostly strings with minimal brass or percussion,1 and have a maximum volume level at 60 dB" (Nilsson U 2008).

This reveals that slower, instrumental songs are scientifically proven to be the best source of music to help relieve feelings of anxiety. Classical music falls into this category as it is a purely instrumental art form with no words spoken. It is composed of strings; such as the violin, cello and the bass, woodwinds; such as the flute or clarinet, and subtle percussion. Ultimately, the pain and distress a person feels when having an anxiety attack can be lessened with the right kind of music. The low-toned calming aspect of classical music makes it the perfect example of songs an individual should listen to when they're having overwhelming feelings of angst.

Physical Effects

However, the effects of music stem way deeper than just shifting one's mood. Music has been shown to have even more powerful implications on the mind and can go as far as lessening effects of brain damage. Music therapy has been scientifically proven to be a tool that can aid in recovery of some severe types of brain damage including Alzheimer's Disease and dementia.

Music therapy has been shown to be a mechanism of recovery in patients suffering with Alzheimer's Disease (AD) and dementia. Music therapy is the use of music to address the physical, emotional, cognitive, and social needs of a group or individual. Essentially, it's using music to accomplish a variety of different goals based on how your mind and body responds to the music.

"Dementia is a neurological condition characterized by gradual death of brain cells that causes a decline in cognitive functioning or thinking skills such as memory" (Baird and Samson 2015). Impaired memory is the most prominent trait of individuals who are suffering with AD. However, even though memory for verbal information is severely impaired, memory for familiar music can be relatively spared. According to Amee Baird and Se´verine Samson, "surprisingly, the ability to respond, to recall, or to produce music by singing, instrumental playing, or composing is often remarkably well preserved even in the severe stage of AD". There are numerous positive effects different music activities have on people with dementia. Listening to familiar music can elicit pleasurable responses such as smiling or liking judgments, participating in singing has been shown to improve behavior, mood, and cognitive function, and other physiological effects such as changes in heart rate and hormone levels that follow music therapy sessions (Baird and Samson 2015).

Their study implies that when “compared with other cognitive functions musical abilities may remain relatively preserved in advanced dementia and serve as a means of communication between patient and caregiver.”

Furthermore, in a study run by Lola L. Cuddy and Jacalyn Duffin, they determined that recognizing familiar music remains functional in patients with AD. In this study, 50 patients, all of whom were diagnosed with AD but at different stages, were given songs that were both familiar and not familiar to them. The songs that were most familiar to them resonated the most and were found to be recognizable. They claimed that “Due to close associative bonds formed early in life between highly familiar song tunes and lyrics, the ability to recognize such information seems to be still functional in patients with AD”. On the other hand, when compared to a distorted tunes test conducted by Drayna D, Manichaikul A, de Lange M, Snieder H, and Spector T, “ the ability to detect pitch distortions (distorted tunes test, from Drayna et al., 2001) or to recall a song prompted by spoken lyrics is frequently impaired”. This reveals that the music itself is what's being recognized by the patients. Semantic memory may be spared due to the combination of the sounds, beats, tunes and lyrics. Lyrics without the tune are processed as just words, and tunes without the lyrics are processed as just sounds. Therefore, music as a whole, formed from the combination of the two, have been shown to be beneficial and help patients with AD.

Conclusion

Ever since its establishment, music has been primarily utilized for entertainment and communication purposes. However, the benefits of this art form stem much deeper than that. Music surrounds us in our daily lives, and has numerous benefits that all people, regardless of age or circumstance, should take more advantage of. Whether you want to shift your mood from

sorrow to excitement, stimulate motivation or concentration, or even to help relieve stress and anxiety, music therapy is an easy and effective way to do so. In more severe circumstances, music has gone as far as helping rehabilitate the brains of patients who have suffered from Alzeheimers disease and dementia. Therefore, music shouldn't just be used as a past-time activity, but instead should be a tool that all people should use to improve the quality of their lives.

In my own life, music has provided me with a way to improve my mood, increase my energy and excitement as well as establish comfort and reassurance when nothing else had worked. When no other method has been shown to be useful, music provided my mind and body with ease while I was suffering with pain and anxiety. Music reached parts of my brain that normal conversations could not and has become the primary source of my relief in times where I needed mental stability. I will continue to use music as not only a coping mechanism but also as a source of inspiration and happiness in my daily life and hope that people learn to do the same.

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